

What is claimed is:

- 1    1.    An induction instrument comprising:  
2        a transmitter for transmitting an electromagnetic signal into a layered formation adjacent  
3        a well bore;  
4        a receiver for receiving a signal from the formation in response to the transmitted elec-  
5        tromagnetic signal; and  
6        a processor for analyzing the received signal for determining from the received signal po-  
7        larity indicative of a direction for a boundary between layers in the well bore.
- 1    2.    The instrument of claim 1, further comprising:  
2        a quadrupole transmitter comprising a first transmitter coil having a moment pointing in a  
3        first direction substantially perpendicular to the borehole axis and a second transmitter  
4        coil having a moment pointing in a direction opposite to the first direction.
- 1    3.    The instrument of claim 2, further comprising:  
2        a receiver positioned between the first and second transmitter coils and having a moment  
3        substantially perpendicular to the borehole axis.  
4
- 1    4.    The instrument of claim 3, wherein the first transmitter coil and second transmitter coil  
2        are separated by a distance of about 10 cm.

1 5. The instrument of claim 2 further comprising:  
2 a switch for reversing a direction for a current flowing in the first transmitter coil so that  
3 the moment of the first transmitter coil and the moment of the second transmitter coil  
4 point in the same direction for obtaining array type induction measurements resistivity  
5 data.

1 6. The instrument of claim 1, further comprising:  
2 electronics for exciting the transmitter at frequencies ranging from 100 kHz to 2 MHz.

1 7. The instrument of claim 2, wherein the opposing transmitter coil moments cancel eddy  
2 currents induced in the conductive drill.

1 8. The instrument of claim 1, wherein the signal received from the formation further com-  
2 prises:  
3 an in-phase and quadrature component.

1 9. The instrument of claim 1, further comprising:  
2 A sign reversal between a signal received from an up boundary for a layer above the in-  
3 strument and the signal received from a down boundary for layer below the instrument.

1 10. The instrument of claim 2, further comprising:  
2 an array of receivers for obtaining array type induction measurements resistivity data.

1 11. A method for determining the direction of layer in a layer formation comprising:  
2 transmitting an electromagnetic signal into a layered formation adjacent a well bore;  
3 receiving a signal from the formation in response to the transmitted electromagnetic sig-  
4 nal; and  
5 determining from the received signal polarity a direction for a boundary between layers in  
6 the well bore.

1 12. The method of claim 11, further comprising:  
2 directing a current into a first transmitter of a quadrupole transmitter thereby generating a  
3 moment pointing in a first moment direction; and  
4 directing current into a second transmitter coil of a quadrupole transmitter thereby gener-  
5 ating a moment pointing in a direction opposite to the first moment direction.

1 13. The method of 12, further comprising:  
2 positioning a receiver between the first and second transmitter coils for receiving a signal  
3 from the formation.

1 14. The method of claim 13, further comprising:  
2 separating the first transmitter coil and second transmitter coil by a distance of about 10  
3 cm.

1 15. The method of claim 12 further comprising:

2 reversing a direction for a current flowing in the first transmitter coil so that the moment  
3 of the first transmitter coil and the moment of the second transmitter coil point in the  
4 same direction for obtaining array type induction resistivity measurement data.

1 16. The method of claim 11, further comprising:  
2 exciting the transmitter at frequencies ranging from 100 kHz to 2 MHz.

1 17. The method of claim 12, further comprising:  
2 generating opposing transmitter coil moments for canceling eddy currents induced  
3 in the conductive drill.

1 18. The method of claim 11 further comprising:  
2 obtaining array type induction measurements resistivity data

1 19. The method of claim 11, further comprising:  
2 processing an in-phase and quadrature component of the signal received from the forma-  
3 tion.

1 20. The method of claim 11, further comprising:  
2 detecting a sign reversal between a signal received from an up boundary for a layer above  
3 the instrument and a signal received from a down boundary for a layer below the instru-  
4 ment.

1 21. A computer readable medium containing instruction that when executed by a computer  
2 perform a method for determining the direction of layer in a layer formation comprising:  
3 transmitting an electromagnetic signal into a layered formation adjacent a well bore;  
4 receiving a signal from the formation in response to the transmitted electromagnetic sig-  
5 nal; and  
6 determining from the received signal polarity a direction for a boundary between layers in  
7 the well bore.

1 22. The medium of claim 21, further comprising:  
2 directing a current into a first transmitter of a quadrupole transmitter thereby generating a  
3 moment pointing in a first moment direction substantially perpendicular to the bore hole  
4 axis; and  
5 directing current into a second transmitter coil of a quadrupole transmitter thereby gener-  
6 ating a moment pointing in a direction opposite to the first moment direction.

1 23. The medium of 22, further comprising:  
2 positioning a receiver between the first and second transmitter coils for receiving a signal  
3 from the formation.

1 24. The medium of claim 23, further comprising:  
2 separating the first transmitter coil and second transmitter coil by a distance of about 10  
3 cm.

1    25.    The medium of claim 22 further comprising:  
2           reversing a direction for a current flowing in the first transmitter coil so that the moment  
3           of the first transmitter coil and the moment of the second transmitter coil point in the  
4           same direction for obtaining array type induction measurements resistivity data.

1    26.    The medium of claim 21, further comprising:  
2           exciting the transmitter at frequencies ranging from 100 kHz to 2 MHz.

1    27.    The medium of claim 22, further comprising:  
2           generating opposing transmitter coil moments for canceling eddy currents induced in the  
3           conductive drill.

1    28.    The medium of claim 21 further comprising:  
2           obtaining array type induction measurements resistivity data.

1    29.    The medium of claim 21, wherein the signal received from the formation further com-  
2           prises:  
3           processing an in-phase and quadrature component of the signal received from the forma-  
4           tion.

1    30.    The medium of claim 21, further comprising:

2 detecting a sign reversal between a signal received from an up boundary for a layer above  
3 the instrument and a signal received from a down boundary for a layer below the instru-  
4 ment.